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SMUD's Power Choice Pilot

A Critical Peak Pricing Program for Residential Customers

Presented to:

Customer Response to Dynamic Prices and
Demand Response Programs Workshop

June 8, 2004

Sacramento, CA

Purpose of Pilot

- Test the technology
- Test response to a time-of-use rate with a critical pricing period component
- Assess participants' acceptance and satisfaction

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Key Players

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- Program and Project Management
- Evaluation
- Meter Shop
- Billing
- Information Technology
- Office Support
- Advertising
- Pricing (Rates)
- Metering (MV-90)

Contractors

- Comverge Inc.
- KC Electric
- ABB Inc.
- Summit Blue Consulting
- JD Franz Research

Partners

- California Energy Commission
- Dr. Loren Lutzenhiser

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Program Description

- Residential customer sample of 78 installations
- Contract with CEC to provide research into future rulemaking process on residential demand responsiveness
- Co-funded by CEC and SMUD
- Pilot operated during summer of 2003
- Automatic control of HVAC, electric water heating and pool pump motors

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Key Components

- Equipment
  - Communication gateway
  - Load control relay
  - Thermostat/controller
  - Special electric meter with adapter
- Software
  - Head-end system
  - Energy On-line Profiler
  - Billing software
- Rate structure

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Infrastructure Systems

- Billing
- Communication to and from home
- Meter data integrity
- Online diagnostic tool
- Online critical peak event scheduling
- Access to billing data
- Load profiling
- Data hosting (head-end database)

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Eligibility Requirements

- Save a minimum of $50 with 90 critical hours, $0 with 140 hours
- Touch tone phone and Internet access
- Central AC or heat pump compatible with equipment (zoned and variable speed HVAC systems do not qualify)
- Service panel rated at 200 amps or less and compatible with hardware
- Electric water heater and/or pool pump motor

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Customer Acquisition Process

- Sent direct mail solicitation to more than 30,000 customers
- Called more than 4,000 customers
- Received 570 agreements for a 2% response rate
- Screened for eligibility, identified 177 potential enrollments
- Installed 78 systems

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Print Materials

- Direct mail marketing
  - Cover letter
  - Brochure
  - Participation agreement
- 100-page thermostat manual
- Refrigerator magnet showing TOU periods and pricing

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Installation Issues

- 88% of responding customers' panels were incompatible with the equipment
- Inoperable or ineligible equipment
- Inaccessible phone line
- Coordination of installation activities difficult among Meter Shop, contractor and customer

Customer Education

- Performed energy audit
- Trained the homeowner how to program the thermostat/controller and become familiar with use of the system
- Trained the homeowner how to access and view load profile and energy use information on the web

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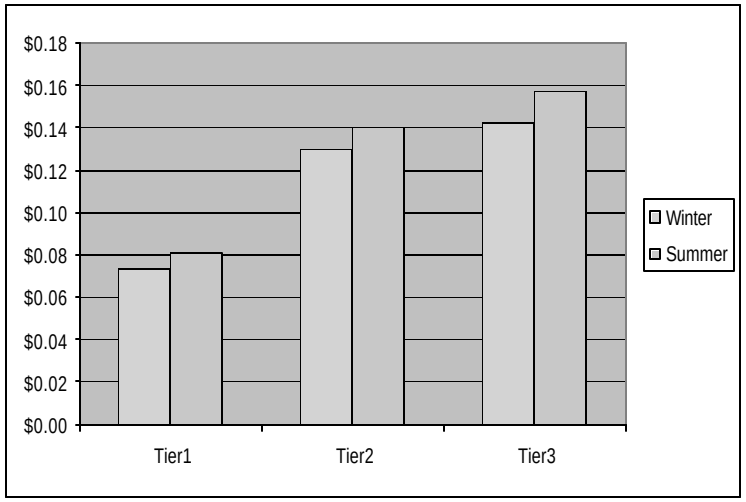
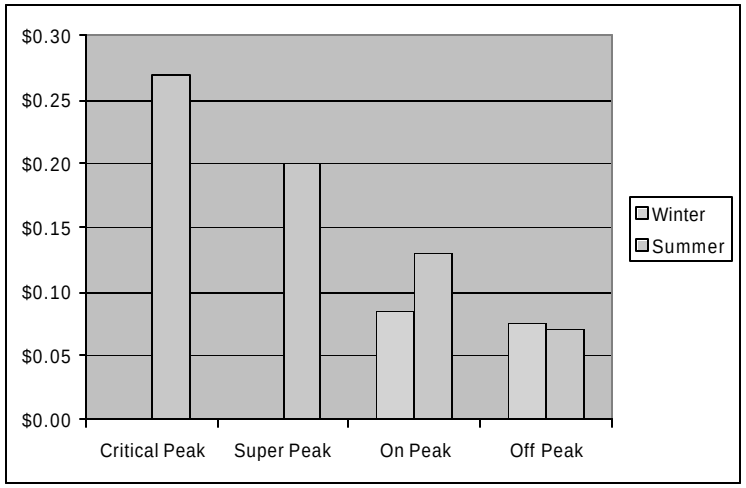
Rate Comparison

Standard	Winter	Summer
Customer Charge	$5.00	$5.00
Tier1	$0.07378	$0.08058
Tier2	$0.12995	$0.13965
Tier3	$0.14231	$0.15688



Power Choice	Winter	Summer
Customer Charge	$10.00	$10.00
Critical		$0.27000
High		$0.20007
Medium	$0.08411	$0.12948
Low	$0.07620	$0.07032



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Bill Differences

- Some customers benefit simply by changing rates and not energy use patterns
- Seasonal advantage for gas heat customers because they do not reach standard rate Tiers 2 and 3 in winter
- Standard summer Tiers 1 and 2 are only 1¢ higher than low and medium Power Choice periods
- For low users to break even during summer, they need to use almost all electricity in low period
- High users who pay Tier 2 and 3 rates already use some of this electricity during the low and medium period

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Critical Peak Triggers

- Critical peak pricing triggered when:
  - Forecasted day-ahead temperature exceeds 95°F and SMUD system load exceeds 2,100 MW
  - Price of power on the wholesale market exceeds $90/MWh
  - System emergency (i.e. major transmission line goes down in California)
- All critical peak events triggered during summer 2003 (57 hours billed) were based on temperature and load trigger

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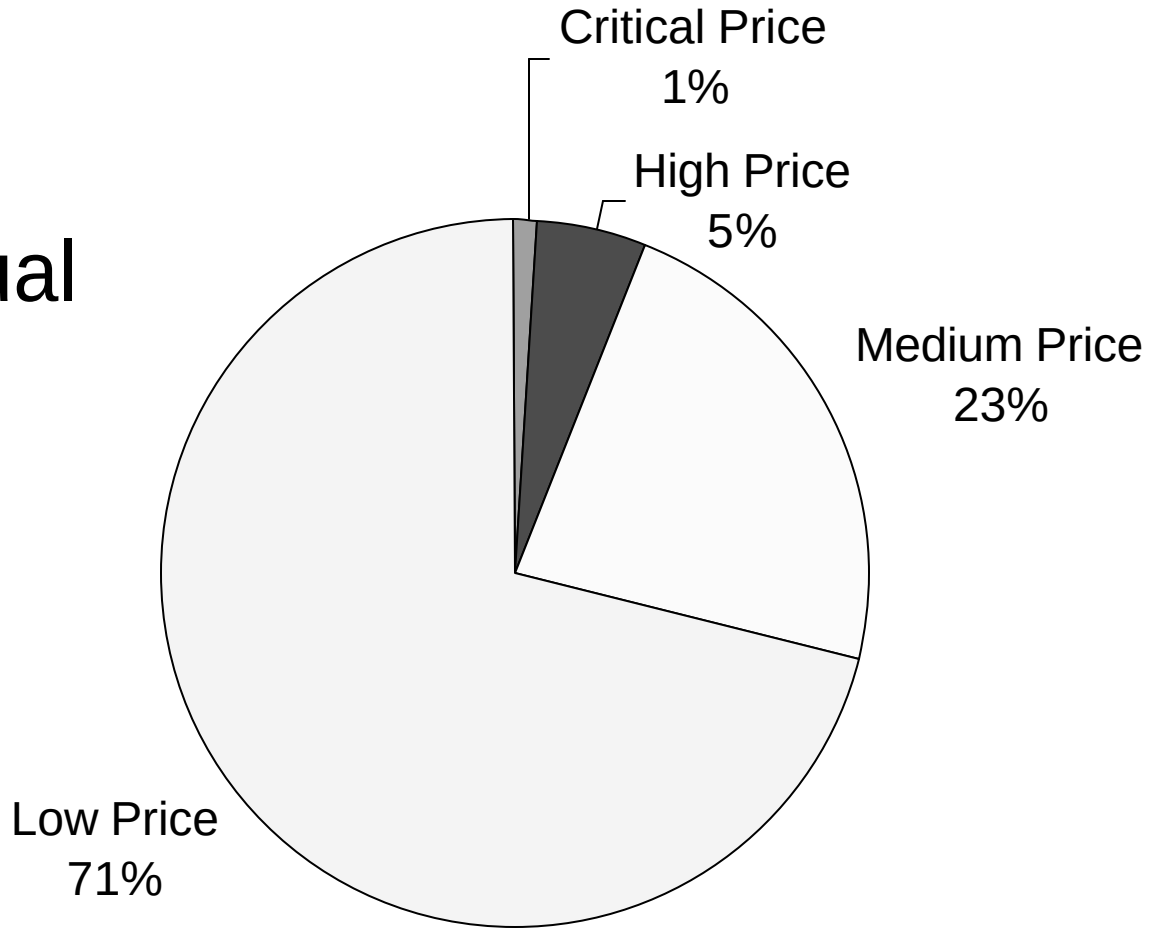
Rates in Effect

Percent of Annual Hours



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Summer Demand Savings

Time Period	Percentage Savings	Average kW Per Participant Pre-TOU	kW Savings All Participants
Low	-1%	2.1	-1.6
Medium	8%	2.3	14.3
High	11%	2.6	22.3
Critical	16%	3.4	42.3

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Summer Energy Savings

Time Period	Average kW Savings Per Participant	Number of Hours in Period	kWh Savings Per Participant	kWh Savings All Participants
Low	-0.02	1,708	-34	-2,652
Medium	0.18	488	88	6,864
High	0.29	732	212	16,536
Critical	0.54	57	31	2,418

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Energy Savings Factors

- Overall energy savings was reduced by 4% during June – September
  - Reduced equipment operation
  - Changes in equipment
- Considerable investments made in energy efficient equipment after joining Power Choice
  - 49% - Replaced incandescents with CFLs
  - 15% - Replaced windows
  - 12% - Replaced refrigerators
  - 10% - Repaired ducts
  - 5% - Replaced air conditioners

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Participant Characteristics

- Well educated with high income
- Live in large (2,292 sq. ft.), gas-heated home
- High energy usage (1,565 kWh/month)
- Home during summer peak hours
- Participates in other energy efficiency programs

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Energy Use Behaviors

- 95% felt shifting usage became a habit
- 60% knew prices, 87% knew time periods
- 40% had disagreements about using energy
  - Air conditioner and laundry use
- Most used less A/C, washing, drying, cooking, bathing during high and critical periods
- 83% checked the display for a critical event
- 60% temporary overrode settings; 40% changed default temperatures; 10% changed critical peak settings

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Energy Use Relationships

- Knowledge of exact prices and time periods is unrelated to energy savings
- Participants who adjusted temperature during critical period saved least during critical period
- Participants who checked the thermostat and website saved most during critical period
- Participants who invested in energy efficiency saved more during high and critical periods and used less overall

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Satisfaction

- 79% of participants were satisfied, 11% were dissatisfied
- 40% concerned about lifestyle changes, equipment difficulties, bill increases
- High importance: ability to save money, control thermostat and appliances use, information about energy usage and notification of critical peak events
- Lower importance (still a majority): education and whether SMUD owns the equipment
- Thermostat issues lowered satisfaction
  - Hard to program
  - Hard to see—small display and no backlight

Process Findings

- Pilot administration and maintenance was expensive
- Setting up infrastructure was labor intensive—required integrating many computer systems
- Equipment installation process was complicated—installation time varied depending on complexity of the installation
- Despite training, 44% of participants had difficulty programming and/or operating the thermostat
- Customer education and communication was an important part of enabling customers to fully benefit from the program
- Program attrition was very low

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Next Steps

- Monitor changes in technology
- Monitor equipment and installation costs
- Monitor statewide trends
  - Workshops
  - Research
  - Proposed legislation

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Equipment Components

Thermostat/Controller Gateway Load Control Relay

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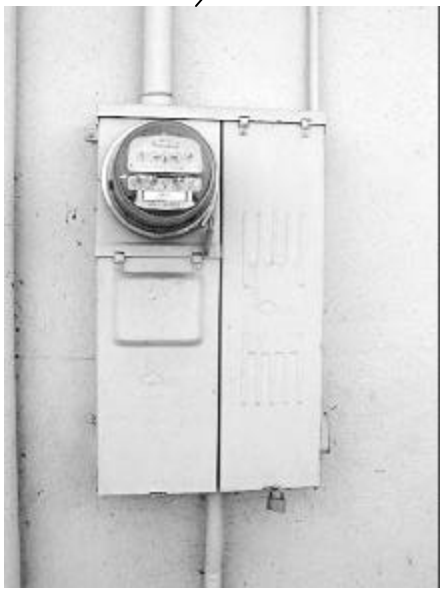
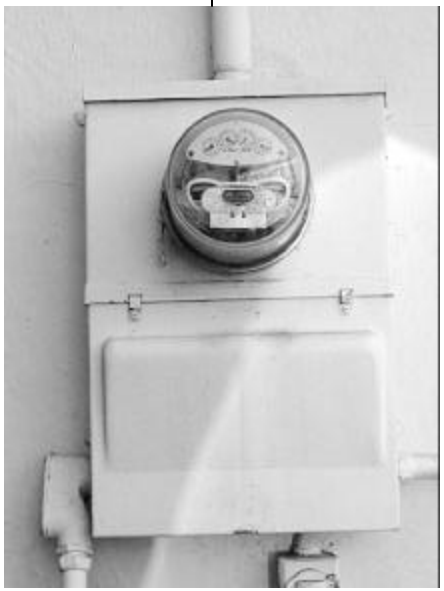
Electrical Panel Compatibility

Incompatible



Compatible



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